Institution: The Institute of Cancer Research

Unit of Assessment: Biological Sciences UoA5

a. Context

The Institute of Cancer Research (ICR) is committed to carrying out research in such a way that it can be exploited to its maximum potential for the benefit of the public. The ICR's approach to impact is driven by this philosophy and has the aim of ensuring appropriate and effective exploitation and dissemination of research findings to maximise speed to patient benefit. Our highest priority is to achieve direct improvement of cancer patient care and health outcomes through earlier diagnosis, more targeted and effective treatments, the reduction in side effects and improved quality of life. However, in pursuing these aims we also have considerable commercial impact in the biotechnology and pharmaceutical sectors.

We actively pursue the avenues opened up by our biological research through collaboration with colleagues in UoA1 (Clinical Sciences) and The Royal Marsden NHS Foundation Trust (RM) who are well equipped to carry out drug discovery, translational research, experimental medicine and early phase clinical trials. We facilitate the development of our research by others through our approach to commercialisation of intellectual property. We collaborate with biotechnology companies and the pharmaceutical industry to take research ideas through all phases of drug development and work with equipment manufacturers to develop the technologies for diagnostics and imaging. We participate in national policy development and work with cancer charities to support fundraising and public awareness and political lobbying.

b. Approach to impact

The ICR's aim is to ensure appropriate and effective exploitation and dissemination of research findings to maximise speed to patient benefit.

Researchers are encouraged to engage early with colleagues in UoA1, especially in clinical genetics, cancer therapeutics and clinical studies, and/or industry partners capable of translating their research into products and services. The ICR has its own translational funds, the Faringdon Fund awards, which provide up to £50,000 for initial proof of concept studies, and the ICR also encourages external applications, for example to the Wellcome Trust. Between 2008 and 2013, the ICR granted over 50 licences and assignments of intellectual property resulting from research in UoA5 and received invention income of £366k from 14 distinct inventions.

The ICR and RM were awarded NIHR-BRC status in 2007 as the only specialist BRC dedicated to cancer and this was successfully renewed in 2012. This funding, together with that derived from being a Cancer Research UK Centre of Excellence and Experimental Cancer Medicine Centre, enables us to support an infrastructure in which we can systematically apply the findings of cancer gene discovery, cell and molecular biology and structural biology to cancer drug discovery and through translational steps of tumour profiling, molecular pathology diagnostics, predictive and pharmacodynamic biomarkers into Phase I proof of concept studies and molecular imaging supported tumour specific Phase II clinical trials.

Although achieving commercial impact from our intellectual property is important, we do not necessarily choose to maximise this on all occasions. Before making any decision to commercialise, an assessment is made of whether this would provide the maximum benefit to patients, and in some instances it is decided they would be better served by making the technology widely available through publication. However, we have learned that we may need to act pre-emptively. For example, our initial policy was to publish novel cancer genes, but others may patent before the publication comes out. More recently, therefore, the ICR strategy is to file early patents that can either be dropped after publication once it is clear that no one else has patented (eg BRIP1, PALB2), or the patent is maintained but multiple non-exclusive licences are granted, as with BRAF.

Where necessary, we work in collaboration with commercial organisations to facilitate the development of the product or service, for example the collaboration between our genetics researchers and Illumina Inc. to produce a test allowing the simultaneous screening of an array of cancer susceptibility genes. Under the agreement, Illumina provided equipment, reagents and

expertise in high throughput sequencing; the ICR provided expertise in the identification of cancer susceptibility genes and curation of the panel. The resulting product is a highly multiplexed targeted resequencing assay for detecting somatic mutations, recently marketed as Trusight Cancer (http://www.illumina.com/products/trusight_cancer.ilmn). The ICR receives a royalty on sales.

Interaction with industry is vital for taking promising new drugs through the various stages of development, approval and launch onto the market. We monitor progress even after any formal collaboration period has ended to ensure that the impact is being realised. If partner organisations discontinue development, we have mechanisms in place to ensure that the results are returned to us, so that we can seek other opportunities to exploit them. Where the lead on commercialisation is being taken by another organisation, for example Cancer Research Technology or Wellcome Trust, these principles are enshrined in our agreement with them, and they are obliged to ensure relevant terms are included in any contracts.

The ICR sets up commercial agreements that leave scientists freedom to operate and therefore able to work with multiple companies in the same field. The consequence of non-exclusive arrangements is less income but a greater likelihood of patient benefit. This principle applies to collaborations where the company has discovered the drug and the ICR helps with development, such as our work with KuDOS and Biomarin to develop PARP1/2 inhibitors such as olaparib and BMN673.

Under certain circumstances, the ICR creates spin-out companies. With a novel technology, rather than a novel product, a services company can be a better route than just publishing or licensing; the company can convert the invention to practical application and offer the technology to customers worldwide (see Domainex Impact Case Study).

Many of these points are exemplified by our current work on tankyrase inhibitors. Work to translate initial findings identifying tankyrase as a drug target into a novel therapeutic has been funded by two seeding drug discovery awards (SDDI), total value of nearly £8 million, from the Wellcome Trust. Structural biology and lead identification has been subcontracted to Domainex, the company the ICR set up to exploit the technology developed at the ICR. CDAs have now been put in place to enable discussion with potential partners to take the compounds through clinical trials. Our intention is to sign a collaborative licence agreement with one of these companies, where we continue to contribute to the project, rather than simply “selling off” the programme. The ICR will continue parallel research, aimed at identifying biomarkers of tankyrase inhibitor response and additional indications for which tankyrase inhibitors could be used, to accelerate progression to the clinic.

Around 7% of ICR researchers have a background in industry: all are provided with opportunities to develop commercial and entrepreneurial skills. The ICR runs workshops on how to develop successful interactions with industry and exploitation of IP as well as training in related skills such as public speaking and science communication. During the assessment period almost 200 researchers undertook this training. All research students are provided with information on commercialising research through a novel web based platform. Researchers can utilise up to 6 hours per week of their time for external activities such as providing consultancy services for companies or sitting on policy committees. Researchers may set up these interactions either independently or acting through the ICR Enterprise Unit. The Enterprise Unit, part funded by HEIF and part funded by the ICR’s own resources, is staffed by highly trained and experienced business development professionals who have familiarity both with the ICR’s research base and of working with industry.

c. Strategy and plans

For the next period, as before, the ICR’s aim is to ensure appropriate and effective exploitation and dissemination of research findings to maximise speed to patient benefit; our strategy for impact will therefore remain as described above.

- Our primary objective for our discoveries is that they are developed first and foremost for patient benefit, though we seek to achieve a fair financial return as an outcome for any

exploitation by commercial organisations. If a discovery such as a diagnostic or biomarker can be used widely with little or no further development, it will be made freely available or through non-exclusive licensing. Exclusive licensing will be limited to those discoveries, primarily new therapeutics, which require substantial further investment from an industrial partner to realise patient benefit.

- We recognise the added value and impact that early partnering with industry can bring to many research programmes, for example; through access to increased resources, research tools and complementary skills, and we will continue to promote and increase our interactions with the business community to ensure that our research discoveries can be developed in the timeliest manner. Education of ICR scientists, particularly early career researchers, in intellectual property and commercialisation issues and in seeing impact as part of their role will also continue to be promoted.
- Identifying funding for our translational work will continue to be important. In some cases it is appropriate for us to retain projects seen by industry as high risk for longer, and ICR will use internal funds for this. In addition to the Faringdon Fund referred to above, in the next period we will be able to draw on funding arising from the innovative Battle Against Cancer Investment Trust (BACIT), a fund of funds investment trust that does not charge fees but instead makes donations to a number of charities, of which ICR is the major recipient. Each year BACIT will donate 0.5% of NAV (over £2 million) to the ICR and additionally may invest up to 1% (£4.5 million) to acquire interests in drug development and medical innovation projects undertaken by the ICR (http://www.bacitltd.com/wp-content/uploads/BACIT-FactSheet-Jul-2013.pdf).
- We are increasingly viewing influence on public policy not simply as a consequence of conducting high-quality science, but as an objective we must actively work towards in order to maximise the impact of our research. Our new communications strategy strengthens our focus on policy and public affairs as a way of helping maintain a supportive environment for medical research, and ensuring our research delivers benefits for patients. We have recently formed a new communications directorate to pro-actively pursue these aims.

d. Relationship to case studies

In the **BRAF** case**,** a patent was filed pre-emptively, but non-exclusive licences were granted, which have enabled the initiation of new drug discovery activity in over 20 companies. In parallel, the ICR has driven its own drug discovery programme and continued laboratory research which has been important in identifying mechanisms of drug resistance and understanding which patient groups would benefit from the drug. The first BRAF inhibitor has reached the market, and cancer patients are benefiting worldwide.

The **BRCA cancer predisposition gene** case shows how peer reviewed publication can lead to impact, in this case the introduction of frequent monitoring of those identified, through genetic testing, to be at high risk of breast cancer. It also demonstrates how the ICR systematically takes research findings and follows them through in translational and clinical studies; in this instance to develop a more effective and safer imaging method to enable more screening. The publication of research providing proof of concept for synthetic lethal therapeutics prompted the initiation of new drug discovery activity in multiple pharmaceutical companies. By signing non-exclusive agreements, ICR scientists are free to act as advisors to multiple companies and again, colleagues in UoA1 have led the Phase I/II proof of concept trials.

The **PKB** case is another example of where we have issued multiple licenses and in parallel pursued an ICR driven drug discovery programme to maximise the chances that the scientific breakthrough ultimately results in patient benefit. In this case, six international pharmaceutical companies have been licensed with reagents to enable them to begin PKB drug discovery programmes. The ICR team used their structural biology expertise to progress the ICR's own PKB inhibitor programme, as a result of which two series of inhibitors are now licensed (AstraZeneca and Astex) and in clinical trial.

The **Domainex** case is an example where**,** to commercialise a novel technology rather than a novel product, it was decided that setting up a services company was a better route than just publishing, to ensure that the technology of combinatorial domain hunting was developed and exploited. The ICR founded a spin-out company, the ICR lead researcher became the Chief Scientific Officer and the ICR continued to oversee and support the commercialisation through a non-executive directorship. Domainex and the ICR are currently collaborating on the tankyrase inhibitor project funded by a SDDI award from the Wellcome Trust.